APPENDIX C
GENERAL DESCRIPTION OF CSO FACILITIES

This appendix provides a general description of the types of CSO control facilities included in the three alternatives compared in this final joint document.

Outfalls

Outfall pipes are usually sited to optimize discharge location in terms of dilution and dispersion while minimizing shoreward drift. Stormwater outfalls discharge at shallow depths; many discharge just off shore. CSO outfalls discharge at greater depth farther off shore into Elliott Bay where flushing of effluent by currents is a factor in outfall site selection. Generally, an outfall depth of about 200 feet is considered ideal because the discharge is usually trapped in the upper water layer where it will exit Puget Sound as quickly as possible. With discharges at a depth less than 100 feet and under certain conditions with discharges at 200 feet, it is possible that some CSOs will break the sea surface and reach the shore; discharges at 600 feet of depth will reside in the lower water layer and lead to higher effluent concentrations in southern Puget Sound. CSO outfall siting decisions are further complicated by the locally poor mixing found in certain areas, regardless of outfall depth.

Extensive off-shore studies are required to determine flow patterns in Elliott Bay. Once these studies are completed, the optimal outfall location can be identified based on dilution and dispersion modeling.

The CSO outfall pipe is constructed underground from the effluent pumping station, over land and through the intertidal zone to a depth where it can safely be laid on the floor of the receiving water body. Based on water quality, either an open-ended pipe or diffuser is attached to the end of the outfall. A diffuser has openings, or ports, along its length, allowing the effluent to exit the pipe in a dispersed manner to facilitate dilution. Diffusers require a flat spot offshore at the appropriate depth.

Conveyance Facilities

CSO and stormwater conveyance systems consist primarily of buried pipelines and constructed in street rights-of-way, where practical. Pipelines can be gravity mains in which the flows move in a downhill direction or force mains where the wastewater is pushed by a pumping station either to the top of a grade or along a grade that is too flat for adequate gravity flow. Force mains can be constructed at a relatively shallow depth because the associated pumping station allows sewage to flow against gravity. However, gravity mains must often be built at much greater depths to maintain flow.

Regulating Structures

Regulating structures include diversion structures and regulators. Regulator stations are located on large pipes where there is constrained capacity downstream. In a combined sewer system, the regulator and diversion structure route excess flows to another conveyance facility or a CSO outfall after all available storage capacity in the upstream large pipe has been used. Regulating structures are located mostly underground, although a small structure may appear at the surface.

CSO Control Facilities

Control facilities include storage and treatment facilities. The facilities required to store and treat CSOs include tunnels, tanks, vortex separators, and/or microscreens; influent and effluent pumps; peak flow outfalls to discharge excess flow to receiving waters; pipelines between facilities; and possibly odor control and standby power generation. The control facility would allow for screening to remove solids and floatables, some sedimentation based on the detention time in the tanks and tunnels or swirl speed in vortex separator, and possibly disinfection before discharge to receiving waters. Solids removed during storage and treatment would be placed in the EBI and transported to the West Point Treatment Plant.

Tunnels, as typically used for CSO reduction, store flows until capacity exists in the conveyance or treatment system. Tunnels provide an opportunity to avoid temporary surface impacts such as tearing up streets, interrupting traffic, and increasing noise and dust by concentrating the impacts at one or both tunnel portals, located at either end of the tunneled section.

Pump stations are used to boost wastewater flows that can no longer continue by gravity alone. They are constructed mostly underground, although a structure may appear as a building at the surface. Pump stations contain control systems, pumps, standby pumps, emergency power generation equipment, wet and dry wells, and odor and noise control equipment. Wastewater enters the station wet well, which is located at the deepest part, and is pumped up from there to a pipeline. The receiving pipeline can be either a force main or a gravity main. Most CSO control facilities are located fully or partially underground.